

## Abstract

In a hydraulic actuator comprising a hydraulic piston, a hydraulic cylinder and a hydraulic pressure source wherein said hydraulic piston has a larger area exposed to pressure on the side of the control chamber than on the side of oil supply chamber of said hydraulic cylinder, wherein said hydraulic piston has, in its outer peripheral part, a slot connecting said oil supply chamber side with the control chamber side in the direction of shaft and the cross sectional area of the slot in the direction of said shaft changes according to the displacement of the hydraulic piston in the direction of its shaft, and the control chamber has a pilot valve, the suction and exhaust valve in a variable valve system of the internal combustion engine are opened and closed by said hydraulic actuator through a coupling and springs for the valve, for variably controlling the opening and closing timing, the opening and closing time, and the lift of the valve, whereby it is possible to provide a variable valve system for internal combustion engine that is a cam-less and sensor-less, and a hydraulic actuator that enable to reduce power consumption and to improve response speed, and to control landing speed so that a smooth landing may be realized.

**Fig.1**

1. Valve
2. Hydraulic piston
3. Hydraulic cylinder
4. Feedback slot
5. Pilot valve
6. Spring
7. Coupling
8. Hydraulic pump
9. Accumulator
10. Drain
20. Hydraulic actuator
- 21 Oil supply chamber (Ps)
22. Control chamber (Pc,V)
30. Cylinder head of the internal combustion engine

**Fig.2**

**Fig.3**

**Fig.4**

**Fig.5**

Accumulator

Pressure control valve

**Fig.6**

(1) Experiment value

(2) Analysis value

time(ms)

**Fig.7**

Opening and closing signal

time(ms)

**Fig.8**

**Opening and closing signal  
time(ms)**

**Fig.9**  
**Opening and closing signal  
time(ms)**

**Fig.10**  
**Opening and closing signal  
time(ms)**

**Fig.11**